Space Weather Technical Forecast

Issued on Wednesday, 11 May 2022 at 13:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Mainly Quiet geomagnetic activity. Chance of isolated R1-R2 radio blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been High, with an X1.5 at 10/1350UTC which consisted of an impulsive flare from AR3006 combined with a longer flare from AR3007. No conclusive Earth-direct CME component is suspected, but a small shock or disturbance may be evident at L1 on day 4. AR3007 (Esi/βγ) in the southeast quadrant is continuing development in size, but remains fairly simple in complexity at this stage, where AR3006 (now Esi/β) has simplified significantly since yesterday and has uniform looping unconducive to significant flaring. A large number of filaments are visible on the disc and will be monitored for potential eruptions.

Solar Wind / Geomagnetic Activity: The solar wind at L1 has been ambient throughout, averaging under 300km/s, now at 260km/s with density around average. Total interplanetary magnetic field strength was weak, with a brief spike to 10nT at 10/1257UTC and sharp dip in Bz, which may have been due to a CME glancing the Earth's magnetic field. The Bz since 10/1900UTC has been persistently negative between -4 and -5nT, but due to the low speed in wind, no significant geomagnetic activity has been achieved. The Phi angle has remained negative (towards the Sun) throughout. Geomagnetic activity has been Quiet throughout (Kp0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at background levels through the last 24 hours. High energy electron flux (greater than 2MeV) has also been at low background levels. The Electron fluence is well below the Active (1e8 integrated pfu) threshold with a mostly flat trend and a value of 1.29e6 integrated pfu observed at 10/2400UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low with background C-class flux due to the presence of two sizable sunspot regions. There is a continual chance of this increasing into Moderate activity (isolated M flares). The current risk of further X-ray flares is considered very low.

Solar Wind / Geomagnetic Activity: A CME which left the Sun on 06 May was expected to arrive at Earth yesterday (10 May), with a smaller risk of an arrival today on 11 May, although there is a chance we have already seen this with the recent trace in L1 magnetometers. Therefore it is unlikely we will see anything else more significant. Apart from an uncertain chance of activity near the end of the period due to a potential shock from yesterday's X-flare (no significant Earth-directed CME evident) no further features are forecast to affect the Earth. Therefore, geomagnetic activity after today should be mainly Quiet (Kp0-2) with isolated Unsettled (Kp3) periods.

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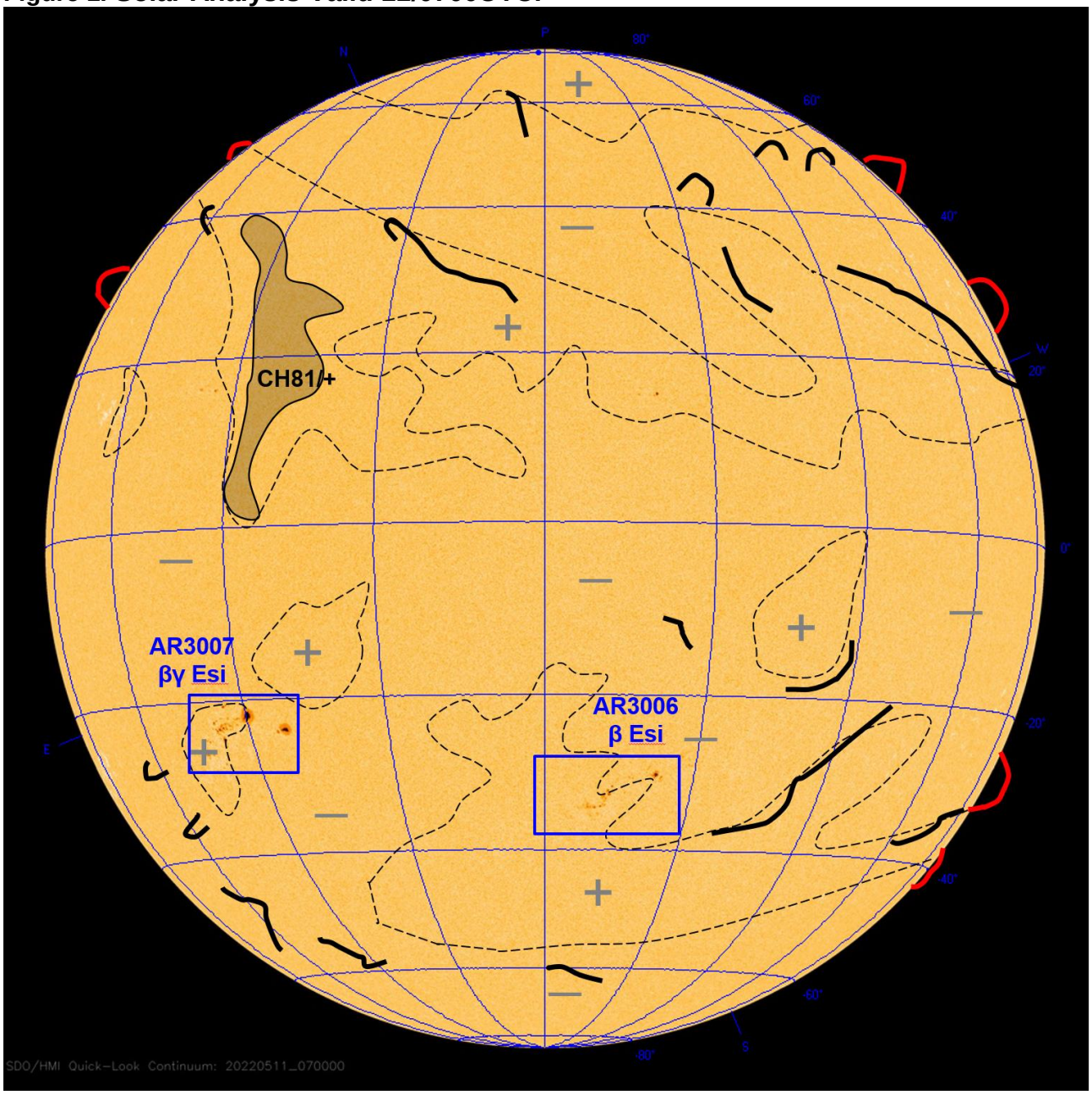
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at background levels until AR3007 rotates into the western limb next week. The high energy electron flux (greater than 2MeV) is forecast to remain at normal background levels. The 24-hour electron fluence is expected to remain below the Active threshold.

Figure 1. Solar Analysis Valid 11/0700UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

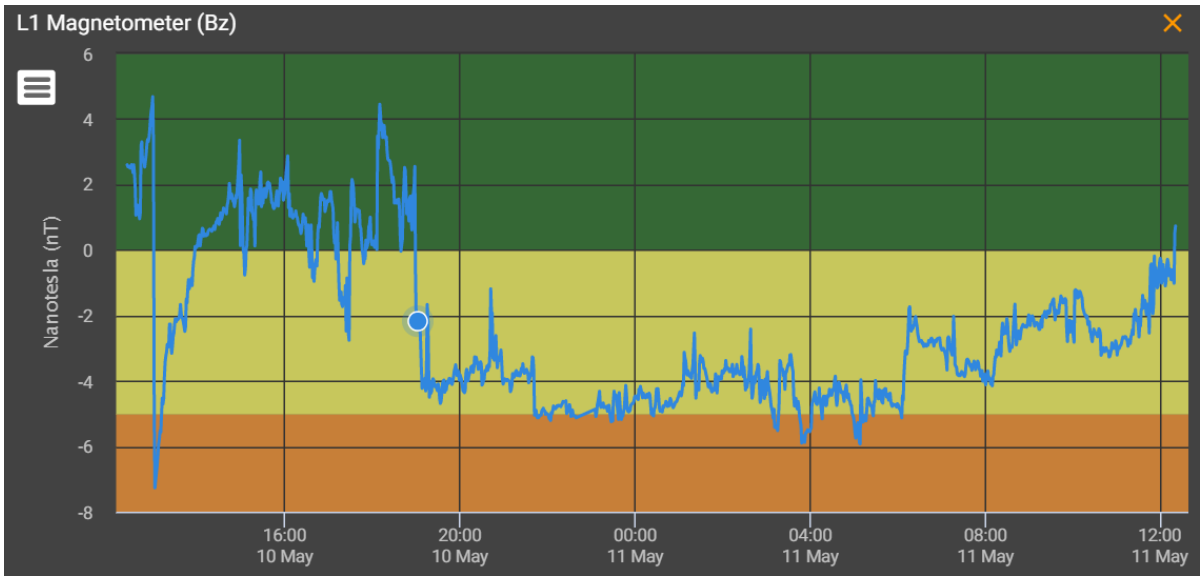
A CME which left the Sun on 06 May was expected to arrive at Earth on 10 May. There is suggestion in the L1 magnetometer data that this feature had already arrived over the past 24 hours, with such a persistent long-period negative Bz, but since the wind is so slow there have not been any geomagnetic impacts. A nominal 5% chance of G1 in the rest of today's forecast indicates that there is still a slight chance of seeing something until midnight before the risk is written-off.

An X1.5 flare on 10 May from south-centre disc appears to have produced an asymmetric CME, combining with a long-period flare from the eastern limb. Current coronagraph analysis is inconclusive and although there is a chance of seeing a transient feature at L1 in 3-4 days time, at this stage it looks unlikely that any significant portion of this CME complex is heading for Earth.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - NONE

Figure 2: Long period significant negative Bz came to no fruition in the geomagnetic indices.



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Radio Blackouts - X-Ray Flares:

Solar activity was High with yesterday's X1.5 (impulsive flare from AR3006 combined with a longer flare from AR3007), however whilst AR3007 (Esi/βγ) in the southeast quadrant continues to show growth, AR3006 (the originator of most of yesterday's flare) has simplified significantly. Analysing the magnetic looping of AR3006 also shows it is well-arranged and relatively untwisted, making it unconducive to further significant flaring. A large number of filaments are visible on the disc and will be monitored for potential eruptions and Hyderflares (flares from magnetic reconnection following the relaxation of a filament).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	30	30	30	30
Very Active	R3 to R5 X Class	Yes	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at low background levels. Solar radiation storms are currently not expected over the next 4 days.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) is expected to be at mainly low background levels through the forecast period with no significant solar winds currently anticipated. Therefore the Electron fluence levels are also expected to remain well below the Active threshold and are not expected to increase significantly at this stage.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^{8}$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^{9}$**	No	1	1	1	1

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